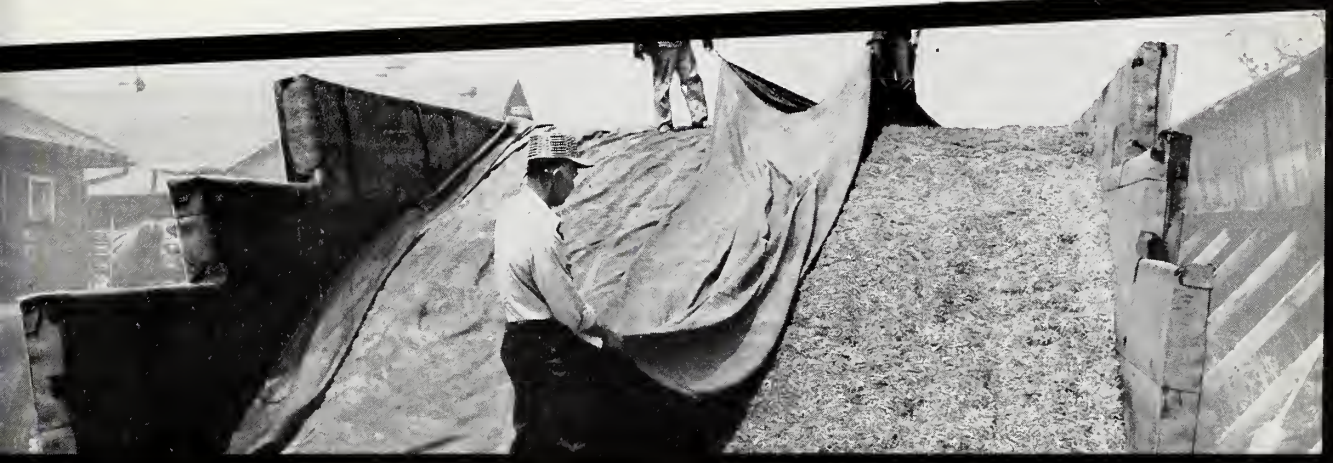
AGRICULTURAL Research

August 1958



U.S. DEPARTMENT OF AGRICULTURE

AGRICULTURAL
Research

Vol. 7—August 1958—No. 2

CONTENTS

Editor: J. F. Silbaugh. Managing Editor: J. R. Deatherage. Contributors to this issue: M. S. Peter, E. Evers, D. R. Klein, V. R. Bourdette, G. F. Snell, R. T. Prescott, R. V. Moffitt.

Challenges

A nation is as strong as its agriculture.

Russia's Nikita Khrushchev reminded us of that not long ago when he told us that communism would win its contest with capitalism when the Soviet's per-capita production of meat, milk, and butter surpassed that of the United States.

Agriculture begins with science.

Everyone knows something of the part science has played in this country's spectacular gain in production capacity.

Science begins with scientists.

It's apparent that we must face this conclusion: The future of agriculture—and in turn, the future of our country—depends on our concern for agricultural science and scientists.

For one thing, we can't assume that agricultural science will take care of itself—that enough young people will choose agricultural research as a career. Careers in science must be made more attractive. Pay is important, but so is prestige.

Then, too, we must broaden our scientific horizons. Right now, for example, we are thinking ahead to the time when we can establish colonies in outer space. When that time comes, agricultural scientists will be called on to adapt or develop methods of producing food on these far-distant places.

In the meantime, we must see that our total scientific effort maintains our world leadership in agriculture. This means building the necessary scientific staff. It also means directing the energies of this staff into areas of research that will help relieve agriculture's main concerns: protecting gains already achieved, improving the balance of agriculture, and guaranteeing abundance for future Americans.

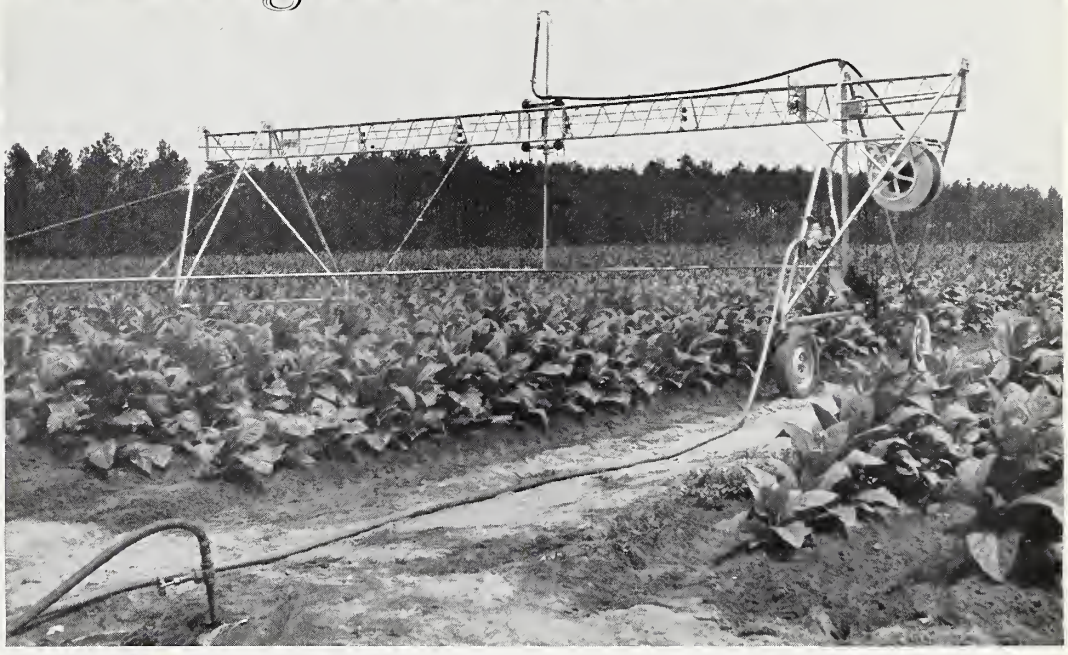
It's a big assignment. Our scientists must be sure their approach is right—that emphasis is given to research areas that will pay off best in the long run. This means more *basic* research—the kind that develops new scientific principles and methods. Many problems will yield only to such efforts.

Greater emphasis on all agricultural research is the key to continued agricultural leadership by the United States. Meeting our challenges calls for a plan that includes an important place for agricultural science—and scientists.

Agricultural Research is published monthly by the Agricultural Research Service, United States Department of Agriculture, Washington 25, D. C. The printing of this publication has been approved by the Bureau of the Budget, September 16, 1955. Yearly subscription rate is $1 in the United States and countries of the Postal Union, $1.35 in other countries. Single copies are 15 cents each. Subscription orders should be sent to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Tobacco Irrigation Can **PAY**

Ideal moisture conditions during periods of rapid growth can justify cost of irrigation by increasing tobacco-crop production



EXPERIMENTAL plot irrigator developed to control application rates in irrigation studies was used in tobacco tests.

Irrigating tobacco to maintain as nearly as possible ideal soil moisture levels throughout the period of rapid growth increases yields more than enough to justify the cost, according to USDA and State scientists.

A 7-year cooperative study in Florida, Georgia, North Carolina, and Virginia has shown that irrigating tobacco would be highly profitable in 7 out of 10 years.

Tests conducted at the Georgia Coastal Plain Experiment Station, Tifton, are good examples. These tests showed an average annual yield increase of 254 pounds per acre of irrigated over nonirrigated tobacco. The annual gross income per acre increased by $181.74. In of the 7 years, yields increased by more than 300 pounds of cured leaf per acre, and gross income increased by more than $200 per acre. Of the 7 years, only 2 reflected no benefit from irrigation.

Regular irrigations from the time the plants are knee high until mid-July gave the best yields and the best leaf quality. Frequent early irrigations (before the plants are knee high) tend to retard root growth and leach fertilizer beyond the shallow root zone.

Single weekly irrigations of ¾ to 1 inch of water applied after late May whenever there had been no rain and proportionately less water following limited rainfall) were highly beneficial in those seasons when the crop responded to irrigation. This consistently increased the total yield and the yield of best grades, and usually increased the per-pound value of the crop.

Semiweekly applications of one-half inch of water, however, gave an even better response. On a 4-year average, the semiweekly irrigations produced 215 pounds per acre more of the best leaf grades and 138 pounds more of the best smoking grades than weekly irrigations.

The plan for making frequent light applications probably reduced the overwatering that sometimes occurs when rain closely follows a substantial irrigation. Scientists believe the plan permits a better air-moisture-temperature environment in the soil and minimizes nitrogen leaching and also the drowning hazard that sometimes occurs. Research also shows that it may help to split the fertilizer normally used into two applications.

Irrigation offers several advantages

Some favorable changes have been noticed in irrigated tobacco—a slight reduction in nicotine content and a slower and usually longer burning rate.

All evidence currently available points to irrigation as economically sound. The odds are in favor of the farmer needing irrigation often enough to justify the investment in equipment where good water is plentiful. ☆

An Aid to BETTER SEEDS

Relation of moisture to quality leads to search for improved tests, containers

■ BETTER WAYS OF TESTING moisture content of vegetable and field seeds, and better moisture-proof containers for storage are being devised by USDA researchers.

Seeds can be maintained at higher quality if they're kept under proper moisture control during storage and marketing. The Agricultural Marketing Service therefore wants to develop a plan that's convenient for the trade to use so moisture control can be recommended.

The Federal Seed Act and State seed laws require that seeds be labeled as to purity, germination, and weedseed content. If practical methods of testing and packaging can be devised, it may be desirable to show moisture content also. This would protect consumers.

Studies show that apparently normal seeds with high moisture content are low in germination after short storage periods. In one study, on-the-farm determinations were made of the moisture content of 13 varieties of soybeans. Then they were sent to different sections of the country and stored for the same length of time. Soybeans kept in a humid area had the lowest germination; those stored in a dry area had the highest. The differences indicated that local weather conditions changed the moisture content, and this changed the germination percentage of soybeans taken from the same farm.

Several kinds of material tried for containers

AMS is working in cooperation with the Iowa Agricultural Experiment Station at Ames to determine the best kind of container for storing seeds. An inexpensive, moisture-proof, tear-resistant material is being sought.

Experiments are under way with paper, polyethylene, cellophane, polyester, and laminated film paper. Four kinds of seeds (onion, cabbage, bluegrass, and red fescue) are sealed in small containers. Bags are kept at three different moisture levels. Every 90 days for 1 year, a batch will be opened and seeds tested for germination and rapidity of growth. Tests will be made at 6-mont intervals the second and third year.

Scientists at the Agricultural Research Center, Belts ville, Md., are looking for a method of determining th moisture content of seeds—a method faster and as ac curate as the Karl Fischer laboratory method. Electri moisture meters sometimes are used, but they must b calibrated and checked frequently for accuracy.

With the Fischer technique, 15 minutes are required t test each seed lot. Seeds are ground in a water-free so vent. The solvent absorbs the water from the seed, an the amount of water is determined chemically.

The method is now used as a base for developing an other system using ovens. To date, oven methods ma be inaccurate since too high a temperature brings abou a higher or lower estimate of water than seeds actual contain. On the other hand, too low a temperature do not release all the moisture in ground seed.

Oven method greatly speeds up moisture testing

But the oven test is faster than the Fischer metho Thirty seed lots may be placed in the oven at one tim for 1½ hours. Thus, 60 samples are tested in 3 hours that's 3 minutes per sample, as compared with 15 minut per lot under the standard laboratory method.

Vacuum ovens can remove as much moisture as a ovens, but at a lower temperature. If seeds break dow under high heat, vacuum ovens are usually better.

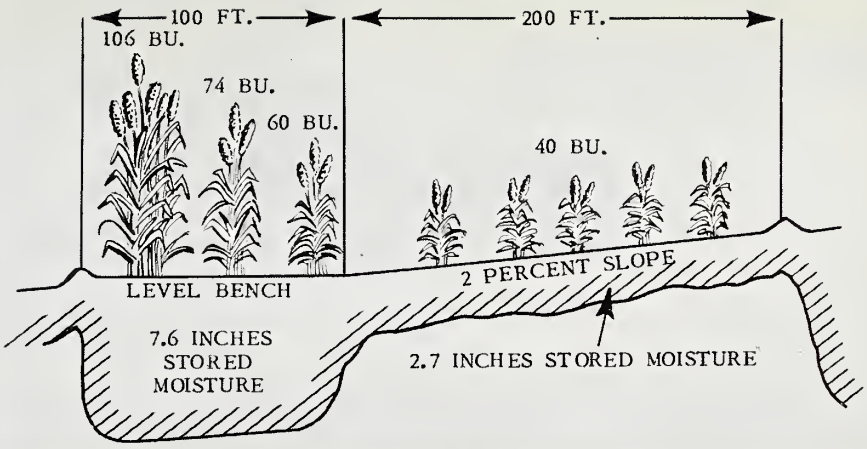
By conducting oven experiments at varying temper tures for varying lengths of time, scientists determine the exact time and temperature for releasing the moi ture present. They have learned that 1 hour at 130° gives values that vary as much as 2 percent from th Fischer results, depending on the type of seed.

Scientists are also experimenting with the use of whol seeds instead of ground ones. Constant temperatures a maintained and the test time is varied until the sam moisture content is obtained.

A chart may be compiled listing for both vacuum an air ovens the correct times and temperatures for all see on the market. With such a chart, recommendatio could be made to guide dealers and protect consumers.

LAND BENCHES BEING STUDIED

'aving of rainfall runoff xpected from new type f contour terracing



WATER-HOLDING ability of combined bench and slope contributed to increased grain-sorghum yield on semiarid land in first test.

A NEW KIND OF CONTOUR terrac- ıg for semiarid lands—wide, level enches separated by even wider rips of natural slope—is being in- estigated by USDA scientists who re seeking ways to check erosion and onserve runoff for crop use.

The tests are being conducted at USDA's Southwestern Great Plains ield Station near Amarillo, Tex. oil researchers A. W. Zingg and V. . Hauser have results from only one rop year, but the results are good nough to warrant further testing.

The scientists constructed 4 level enches totaling 13 acres on a 40-acre lot with a slope ranging from 1 to .8 percent. The benches vary from 100 to 1400 feet in length and from 0 to 145 feet in width.

ench forms natural reservoir

The benches are separated by un- eveled strips of land that contribute unoff water to the benches. The atio of contributing area to bench rea is 2 to 1. Maximum depths of ut and fill were about 1 foot.

Annual rainfall averages about 7.6 inches at Amarillo. Since no unoff data were available, approxi- nations were derived from data from our areas of Texas and Oklahoma vhere soil and terrain are similar. On the basis of these approximations, the researchers estimated runoff each year at zero to 5.7 inches, with an annual average of 1.1 inches.

Practice raised sorghum yield

Grain-sorghum yields over an 18-year period at the Amarillo field station averaged 16.8 bushels per acre. A 1956 irrigation study at Amarillo showed an increase in grain-sorghum yield of 10 bushels per acre for each inch of irrigation water, to a maximum of about 100 bushels.

Rainfall in the Amarillo area frequently comes in downpours rather than in showers. The scientists realized they could not hope to trap all the runoff. They also knew they could not use the ground-stored water as efficiently as water used in the irrigation study. They concluded they could reasonably expect an increase of 5 bushels of grain sorghum per acre for each inch of runoff trapped.

The early variety of Hegari grain sorghum was seeded on the four benches. The intervening strips of normal slope supplying runoff water are in sorghum-wheat-fallow.

The single crop year during which the test was made was unusually moist. At seeding time soil on the benches held more than 7 inches of available water and the contributing areas held almost 3 inches. Similarly, rainfall during the growing season, June 15 to October 15, was recorded at 9.35 inches as opposed to the 8.67-inch average for the season.

Grain yield on the benches was 30.3 bushels per acre. Yield on the contributing area totaled 40 bushels per acre. Both of these figures were somewhat higher than anticipated, and the scientists credit most of it to the better-than-normal moisture conditions. Although these results are highly encouraging, additional tests are needed, particularly in times of average rainfall, to evaluate the feasibility of contour benching.

Semiarid lands may benefit

Conservation benches serve the same function as terraces in controlling runoff. Consequently, adequate outlet capacity must be provided at the bench ends to prevent overtopping of the ridges during severe storms.

In years of above-average rainfall, tilling, planting, and cultivating may be difficult owing to wet ground in the benches. Weed control in wet years is also likely to be difficult and may require use of chemicals.

The initial test indicates that wide benches create natural reservoirs for runoff and the scientists hope that increased production may more than offset the cost of construction. ☆

Making WALNUTS Keep Better

New packaging and antioxidant coating on meats curb rancidity, preserve color and quality

■ PACKAGED ENGLISH WALNUT MEATS with built-in protection against discoloration and rancid off-flavor have resulted from recent research by USDA and the Diamond Walnut Growers, Inc., a grower cooperative.

Research findings now being applied in retail packs of walnut meats will probably help build a demand for the prospective increased production in California and Oregon, the only States that produce walnuts.

Success of the studies at the Fruit and Vegetable Chemistry Laboratory, Pasadena, Calif., has been due to new knowledge of the chemical processes involved in quality loss. Scientists of ARS and the cooperative have discovered that walnuts in the shell contain natural antioxidants in the skins of the nut meats, protecting them against rancidity. But shelling breaks the skins, and exposes the nut meats to atmospheric oxygen.

L. B. Rockland, chemist in charge of the project, and his associates have found that these antioxidants in the skins retard development of rancidity, which results from reaction of the oxygen of the air with the oil in the nuts. The scientists demonstrated that a very light coating of invisible, tasteless antioxidant on the meats slows down rate of rancidification.

The moisture content of the walnut meats also has an effect on rate of spoilage. In these tests, Rockland found that meats were most stable with a moisture content of 3.2 to 3.7 percent. By adjusting moisture to this level and packing the meats in moisture-vapor-resistant bags Rockland was able to protect the quality of the meats enough to give them good storage life.

Similarly, the new package protects natural color of the skins—prevents darkening, which is also the result of reaction with oxygen of surrounding air.

Predictions of future marketing problems prompted the research. Present annual production ranges from 65 to 80 thousand tons. New plantings are expected to increase production to as much as 100 thousand tons. Surveys show a declining willingness of consumers to crack nuts. Consumers prefer high-quality meats ready for use. The research should contribute to that goal. ☆

ANTIOXIDANT coating protects meats. Chemist L. B. Rockland will check for rancidity and darkening.

WALNUT MEATS stored in chamber under controlled moisture will be checked for effect of air moisture.

STORAGE LIFE is increased when meats at optimum moisture are packed in moistureproof bags like this.

THYROIDS AND HEAT TOLERANCE

Thyroid gland acts as "thermostat" in protecting chicks against destructive effects of high temperature

CHICKS WITH LARGE THYROIDS resisted high temperatures better than those with small thyroids in four recent USDA tests at the Agricultural Research Center, Beltsville, Md. New Hampshire chicks especially bred for large thyroids didn't lose as much weight or die in such large numbers. This suggests that the thyroid is involved in protecting chicks against high temperature.

The relationship between low environmental temperature and increased thyroid activity has long been known. But the exact role of the thyroid gland at *all* temperatures wasn't clear. Tests by ARS poultry physiologist M. H. Conner, nutritionist Henry Menge, and agricultural engineer Hajime Ota provided more information on thyroids of chicks exposed to temperatures *above* 95° F. Adrenal-gland response was checked. Body temperature and blood-plasma pH changes were noted in one test.

Endocrine reactions studied

This basic study is contributing much to understanding how endocrine glands of chickens function under extreme environmental conditions.

Test chicks of both sexes were from two genetic lines of New Hampshires especially bred for difference in thyroid size. All chicks were exposed to constant (24 hours a day) high temperatures in a poultry calorimeter. Temperature, humidity, and rate of airflow were controlled. Birds were kept on litter. In all tests but one, chicks were put in the calorimeter at hatching time and kept at the desired temperature for 4 weeks.

Incoming airflow was gradually increased in each test to allow for increase in respiratory and metabolic activity as chicks grew older. Birds were given 14 hours of light daily.

Large thyroid helps combat heat

Chicks with small thyroids didn't do as well during tests as chicks with large thyroids. For instance, small-thyroid chicks weighed less after exposure to constant 95° F. than large-thyroid chicks. In another test where birds were exposed to constant 100° F., the small-thyroid birds had a higher mortality rate (33 percent more) than large-thyroid birds. Surviving small-thyroid chicks had smaller body and thyroid weights, much adrenal enlargement. Adrenal weight of surviving large-thyroid chicks did not change.

Small-thyroid birds also suffered much greater mortality when exposed to an initial high temperature of 105° F., which was gradually lowered to 100° F. But the high temperatures reduced body growth and thyroid size of even large-thyroid birds.

Some of the small-thyroid birds died when exposed to a gradually increasing temperature range of 75° to 95° F. Deaths occurred at the higher temperatures. Body and thyroid weights of survivors were lower, body temperature went up. Blood-plasma pH values were not changed.

High temperatures depressed the development of the thyroid gland in both genetic lines. But the thyroid-size difference between genetic lines wasn't changed. Thus, thyroid activity appears important in protecting chicks against high temperature.

Assays of thyroid activity were performed on untreated chicks. Those with large thyroids were found to secrete more thyroxine than those with small thyroids. Tests don't show if increased activity is proportional to the greater size of the glands or if it's a result of greater activity per unit of thyroid tissue. However, tracer studies with radioactive iodine indicate the increased activity is a function of the thyroid mass.

The extent to which any gland is involved in response to any stress apparently depends upon the conditions to which animals are exposed, and how other glands are involved.

Adrenals are different factor

For instance, high temperatures affected the size of the adrenal gland in only one test—when birds were exposed to constant 100° F. But it is known from tests elsewhere on unselected chicks that the adrenals enlarge consistently when the birds are forced to exercise to exhaustion. The thyroid gland may be more important than the adrenal gland in helping chicks resist death from too much heat. The adrenal gland, however, is more important in other cases.

Studies are planned to clear up the role of the endocrine organs in chickens subjected to extremes of humidity and certain air impurities. ☆

ALKALI BEE, two-thirds size of honeybee, is invaluable pollinizer for alfalfa fields.

MOIST SOILS that have become alkaline through irrigation are favored nesting places for this bee. It constructs a gallery of brood cells underground.

HELPING HELPFUL ALKALI BEES

Spraying nests to control parasites and maintaining nesting sites in good condition promote well-being of these insects

■ METHOXYCHLOR LOOKS PROMISING as a control parasites that destroy beneficial alkali bees—the No west's most important alfalfa pollinator. The princ parasite is the bomblyiid (bee fly).

Nesting sites of bees treated with methoxychlor USDA entomologists had fewer parasites than did same sites, untreated, the previous year. Only 32 per of larvae in nests unearthed last fall were parasiti compared to 96 percent in September 1956.

ARS scientists cooperating with Utah Agricultural periment Station workers sprayed nesting areas wit pounds of methoxychlor in 30 gallons of water in an tempt to rid the area of parasites. More tests will made to determine how effective the chemical is.

Good pollination is a major requisite for alfalfa s production. Alkali-bee females visit about 12 flowers minute and trip about 90 percent. The bees are t

EMALE BEE constructs subterranean cells, supplies
ach with a nectar-moistened ball of pollen for food.
hen she lays egg (left), which grows into larva (right).

SOIL PLUGS containing alkali bee broods are being moved to alfalfa fields by entomologists at Logan, Utah, station.

VILLAIN of the story is bee-fly parasite, shown here hovering over entrance to alkali-bee nest. Pest sweeps own eggs into bee nest.

PARASITE larva emerges and attacks host larva, sucks its body dry, then attacks another.

irds as large as honey bees, with greenish-bronze bands cross the rear portion of their bodies.

They nest primarily in moist alkali soil developed by rrigation. Fields within 2 miles of good nesting sites enerally have enough alkali bees to be effective.

Females construct nests with vertical underground burows branching into 1 or 2 groups of brood cells. The emales then provide each cell with a ball of nectar-noistened pollen, lay an egg on the ball, and seal the cell. fter hatching, the alkali-bee larva eats the food and ompletes its development alone.

lests are moved to fields where needed

Researchers are attempting to establish new nesting ites by moving broods. Steel cylinders measuring about 1 by 11 inches are driven into an established site and ried loose with soil intact. The cylinders are trucked to a new site and the enclosed soil blocks are placed in trenches. A slit down one side of the cylinder allows the block to slide out easily. Because of quarantine restrictions, this method is suitable for local transfers only. For long-distance moving, entomologists are investigating possibilities of placing larvae in wax-coated cells in wooden blocks.

Alfalfa blooming timed for emergence of females

To take advantage of alkali bees, alfalfa blooms need to be timed for the main emergence of females—in July in the Northwest, and somewhat earlier in the Southwest. Growers can maintain alkali-bee sites in proper condition with sufficient subsurface moisture, scanty vegetation, freedom from ploughing and flooding, and protection from skunks. Colonies can be established and competitive sources of pollen and nectar reduced. ☆

Silage keeps well when solidly packed and covered with airtight plastic firmly weighted all over

How to Fill HORIZONTAL SILOS

BUNKER SILAGE is packed while being stored by running the tractor back and forth. This forces air out of the stack and reduces opportunity for development of oxygen-consuming bacteria, which cause deterioration of the silage.

■ IT'S POSSIBLE to produce silage of just as high quality and with just as little spoilage in trenches, bunkers, and horizontal stacks as in costly upright silos. But USDA research (AGR. RES., February 1958, p. 12) showed it takes just the right procedures to achieve this high success.

In studies at the ARS Agricultural Research Center, Beltsville, Md., consistently good results were obtained when silage was mounded, enclosed with an airtight cover stretched tight to eliminate air pockets, sealed snugly at the edges, and weighted overall. Accompanying pictures show silage being put up in this manner. ☆

AIRTIGHT cover of plastic sheeting is tucked in snugly at the edges and laid down over the bunker. All air pockets are pressed out to cut down on the spoilage.

WEIGHTING MATERIAL—preferably sawdust—is packed in the corners and around edges of cover to eliminate openings for entry of more air. When this is done, there is little spoilage at sides of bunker, where much of the spoilage ordinarily occurs.

WORKMEN spread 2 to 3 inches of sawdust to weight down central portion of cover. This enables full contact of cover with silage at all times, even when cover is punctured, and prevents wind from getting under it.

MILK-FED CALVES HAVE FEWER WORMS

Loads of some parasites are smaller—gains better—as result of milk in diet

■ CALVES THAT GET MILK in their diet are likely to have fewer worms than calves given no milk at all.

USDA scientists report this finding from a long-time series of small-scale experiments at the Regional Animal Disease Research Laboratory, Auburn, Ala. Calves on milk harbor fewer worms of certain economically important species, say ARS parasitologists G. H. Rohrbacher, Jr., D. A. Porter, and H. Herlich. Furthermore, milk seems to stunt the worms' growth.

These results suggest that giving calves milk longer than usual might eliminate the need of early treatment for worms. Adding milk to the diet improves gains, too.

The Auburn experiments began with Porter's work on 10 calves raised free of parasites, then paired according to age at 7 to 17 weeks. One calf from each pair had been raised on milk alone; the other got grain and hay along with milk. All were infected with larvae of large stomach worms (*Haemonchus placei*) and killed 4 to 5 weeks later. The calves that had received only milk had smaller worms and far fewer of them, even though the restricted diet didn't allow these animals to gain as well as those that also got grain and hay.

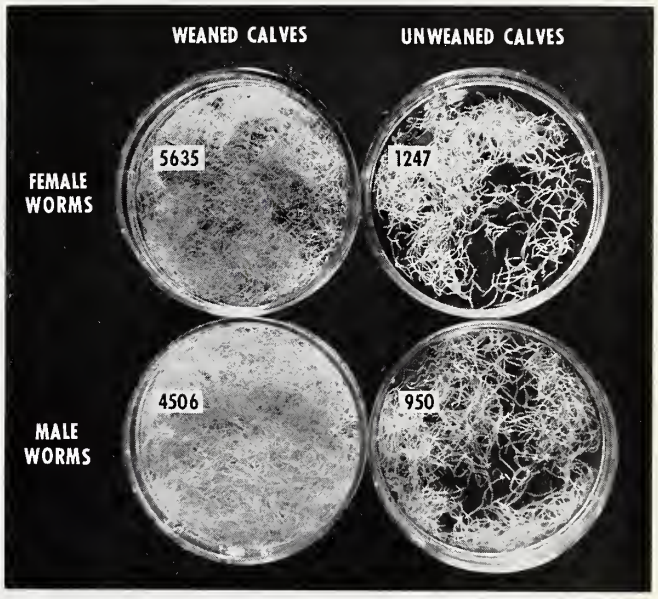
In a similar test, calves on milk, grain, and hay were compared with calves weaned at 12 to 16 weeks. All were infected with *H. placei* and killed a month later. The milk-fed calves had fewer worms and gained better.

Tests cover natural and experimental infections

How about worm infections that are acquired naturally by grazing—does milk have the same effect here as it does in the case of the experimental infections?

To find out, researchers put calves on pasture 54 days. All got a grain supplement, and half the animals got milk twice a day. There was no significant difference in number of stomach worms *Ostertagia ostertagi*, but the calves on milk had fewer *H. placei*, fewer small intestinal worms (*Cooperia* species), and fewer large intestinal worms (*Oesophagostomum radiatum*).

Similar results were obtained with young rabbits in pilot tests. Significantly smaller numbers of small stomach hairworms (*Trichostrongylus axei*) and small intestinal worms (*T. colubriformis*) were recovered from unweaned rabbits than from weaned rabbits after experimental infection. In a comparable test with four calves, however, weaning did not affect these species of worms.



STOMACH WORMS (*Haemonchus placei*) above were recovered from 4-month-old calves, each of which had been experimentally infected with 27,000 worm larvae 35 days before autopsy.

Milk's effect could depend on number of factors

The researchers aren't yet sure of the explanation for milk's effect on parasites. Possibilities include: changed conditions in the gastrointestinal tract; enzymes and other types of protein sugars in milk; calcium provided by the milk; or a combination of factors.

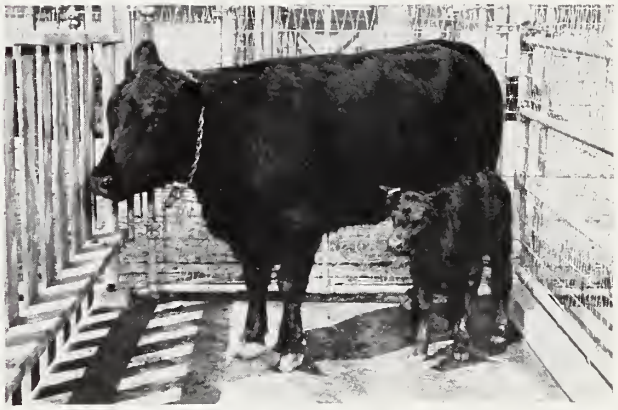
One finding seems significant: milk tends to neutralize acidity in the abomasum (fourth stomach, where digestion takes place). Rohrbacher noted a direct correlation between pH of the abomasum and establishment of *H. placei*—the more the abomasum tends toward neutrality, the fewer the worms and the smaller their size.

Milk's effect has been noted by other researchers. They include ARS parasitologist R. A. Knight, at Mississippi Agricultural Experiment Station, State College. He found that among lambs exposed to natural infections, unweaned lambs had far fewer worms than weaned animals. At the Agricultural Research Center, Beltsville, Md., ARS parasitologist L. A. Spindler and associates fed pigs skim milk alone for 3 days, or once daily in lieu of a grain feeding. The pigs expelled most of their worms and made better gains. ☆

NUTRITION and BEEF CATTLE REPRODUCTION

Scientists are trying a variety of precisely measured rations in research with heifers to conceive and come into hea

HEIFER on full feed shows off her calf in beef-cattle nutrition and reproduction tests at Beltsville.



MEDIUM level of energy feed was given this Angus heifer, shown with her vigorous, sturdy-looking calf.

WEIGHT was just maintained by this heifer fed low-energy pelleted ration. She still managed to produce a calf.

LOW-ENERGY ration was fed this calfless Beltsville heifer. She hasn't been in heat in tests thus far.

■ EFFECTS OF NUTRITION on reproduction in beef cattle are being studied by USDA and the Louisiana Agricultural Experiment Station to understand two major difficulties. One difficulty is failure of some cows to conceive or "settle" after breeding. The other is failure of some cows to come into heat after first calving.

Solution of both troubles is being sought by combined nutrition and breeding studies at the ARS Agricultural Research Center, Beltsville, Md., and at the ARS Iberia Livestock Experiment Station, Jeanerette, La. The work at Beltsville is being conducted by animal physiologist J. N. Wiltbank, cattle nutritionist R. E. Davis, and animal husbandman J. Bond, at Jeanerette by husbandmen W. M. Hazen and E. H. Vernon.

Angus heifers are being used in the Beltsville experiments and heifers of mixed breeding at Jeanerette.

Aside from climate and breeds used, there are no major differences in the trials underway at the two stations. Fifty-four heifers are under test at each station. And in each case the test groups have been divided into 9 lots of 6 animals.

Feed amount, quality controlled

At Beltsville, for example, where the project was started in the fall of 1956, lots 1, 2, and 3 are on full feed. Lots 4, 5, and 6 are on the equivalent of two-thirds full feed. And lots 7, 8, and 9 are fed rations calculated to maintain weight.

In digestible proteins, however, there is another division. Lots 1, 4,

It's yielding clues on failure

and 7 daily receive 0.23 pound of digestible protein per 100 pounds of body weight; lots 2, 5, and 8, a daily ration of 0.15 pound; and lots 3, 6, and 9, only 0.06 pound. Fifteen-hundredths pound per cwt. of body weight is recommended by the National Research Council for normal growth of 600-pound heifers.

In the Beltsville experiment, all feeds are pelleted and heifers on limited amounts of energy (feed) are fed individually. The same feeds are used at Jeanerette, except that they are ground and not pelleted and the heifers are all group fed.

Estrus, conception studied

All heifers went on test late in 1956 or early in 1957 as weanling calves less than a year old. They are being observed for the occurrence of heat or estrus, and ovarian activity is being determined by rectal palpation at regular intervals.

None of the heifers was bred during the first 8 months of the trials. Since then, each heifer has been bred at each heat period. Records are being kept of the conception rate of heifers in each lot, and of the vigor and growth rates of the calves born.

The trials will probably be completed in 1959 or 1960 after each group of heifers has had opportunity to calve twice. Calves have been dropped by heifers in all groups at Beltsville. Several of the heifers, however, have not yet calved.

No attempt will be made to appraise or compare results until trials are completed at both stations. ☆

KNITWEAR THAT FITS

■ Soon women will be able to buy knitwear by standard sizes that can be counted on to fit. Based on scientific measurements, the garments will save the cost of alterations and make buying easier.

This year firms representing more than two-thirds of the national production of women's sweaters, knitted dresses, swimwear, and T-shirts will start using a size standard based on women's measurements taken by the USDA Institute of Home Economics a few years ago. The standard, designated as Commercial Standard CS 215–58 by the U. S. Department of Commerce, can be applied to all women's wear but the knitwear and swimwear industries are first to use it since adoption.

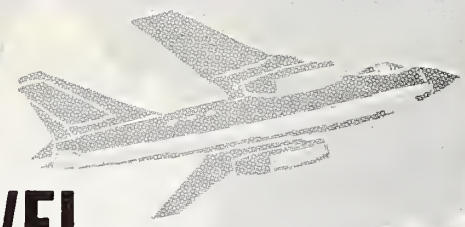
The Department of Commerce established the standard at the suggestion of the American Standards Association. The women's clothing industries indicated the measurements needed. Some cooperators, in addition to the Institute of Home Economics, were National Bureau of Standards, Army Quartermaster Corps, Corset and Brassiere Association of America, and Mail Order Association of America.

The USDA study provides data on the dimensions of 15,000 women—26 vertical measurements and 27 horizontal, as well as angle of shoulder slope and body weight. Studying relationships between measurements, researchers were able to classify body types and find the key measurements from which all others can be predicted. The height-weight combination was found the best basis for indicating size, since neither horizontal nor vertical measurements alone proved adequate.

Up to now, sizes meant different things in each industry. The same woman would wear a size 12 dress, size 34 or 36 sweater, and medium T-shirt. She would buy a bathing suit by dress or bust size or by weight. And each manufacturer used different proportions.

The new standard defines the meaning of size not only for women "regular" in height and "average" in body proportions but also for women who are "tall" or "short" or who have "slender" or "full" hips. The standard will be useful to technical schools of fashion design and give manufacturers a uniform base for sizing all women's garments.

A tentative version of the standard has been used successfully by large nationwide distributors of mail-order merchandise for 3 years. ☆



HOW JET TRAVEL AFFECTS INSECTS

Speed, friction, and intense cold and heat on craft may affect quarantine techniques

■ When aircraft from a foreign country land at our airports, the planes are inspected inside and out.

Plant material that may harbor insects is removed. Inspectors search the interior for larvae, pupae, and adult stages of pests dangerous to agriculture and public health. They look at the wings of the aircraft for egg masses of destructive insects. And they treat infested aircraft with insecticidal aerosols.

But with the coming of the jet age, new quarantine problems arise. Though high altitude may be fatal to insects, high speeds cut the transportation time. USDA entomologists are conducting tests to determine the mortality of insect hitchhikers on jet wings or inside the aircraft in both heated and cold sections.

Experiments have been conducted by ARS entomologists W. N. Sullivan and entomology student E. B. Knipling in the laboratories at Beltsville, Md., and in actual flight tests in cooperation with the U. S. Navy Disease Vector Control Center, Jacksonville, Fla., the Naval Air Test Center, Patuxent River, Md., and the Military Air Transport Service, USAF.

Laboratory studies at Beltsville indicated that several species of insects were killed after 1 hour of refrigeration at 5° to −22° F. During tests at Jacksonville, yellow fever and common malaria mosquitoes, American and German roaches, rat fleas, and flies died in the unheated areas of "Fury" fighter aircraft that flew for a period of 40 minutes at an altitude of 40,000 feet.

Low-temperature exposure kills many insects

Insects were also killed when "Skywarrior" bombers flew for 3 hours at 40,000 feet. Outside temperatures in both instances varied between −58° and −78° F. In some areas warmed by radar and other electronic equipment, insects survived. During flights at lower altitudes, where temperatures are warmer, insects remained alive. What other insects will do under the same conditions and what various insects will do in other sections of the plane is still not known.

On present-day aircraft entering Miami (Fla.) International Airport, *Phalaenidae* egg masses occasionally are found. To determine the effect of jet speeds and altitudes on egg masses, eggs of laboratory-reared armyworms were laid on aluminum foil and the foil taped on the wings of jets before takeoff at Patuxent.

When the aircraft returned, scientists checked the eggs, usually the most difficult stage to destroy, and found they had been killed. Altitudes were up to 40,000 feet with outside temperatures as low as −76° F. More experiments must be made with other species of egg masses before final conclusions can be reached.

Excessive heat inside plane also takes toll

Laboratory tests showed that insects die at excessive temperatures, too. They're unable to stand as much heat as man. To determine how much heat insects could endure from friction in unrefrigerated sections of aircraft in supersonic flight, scientists conducted laboratory tests to estimate the thermal death point of several species. Insects were exposed from 15 to 60 minutes at 104° to 140° F. in an electric oven.

Northern house mosquitoes and common malaria mosquitoes showed 100 percent mortality at 113° F. Yellow fever mosquitoes and Mexican bean beetle larvae were killed at 122° F. and Mexican bean beetle adults, house flies, Japanese beetles, confused flour beetles, and American dog ticks at 131° F. Grasshoppers and Colorado potato beetles were hardest to kill. It took a temperature of 140° F. to kill all these insects.

Temperatures were recorded inside a grounded C–47 fuselage to simulate conditions in an uninsulated jet plane. On half the summer days the temperature inside the plane (parked in the sun) reached 120° F. or higher. Thus, many insects in uninsulated aircraft in the tropics would be killed throughout the year.

These studies help us understand how air transportation may spread insect pests and what safeguards must be provided through quarantine procedures. ☆

EGGS OF ARMY WORM were killed by intense cold in 1-hour ride on wing of jet craft at 40,000 feet and 800 miles per hour. Eggs weren't changed in structure.

More oats with nitrogen

Nitrogen applied at the rate of 40 pounds per acre 2 weeks after seeding produced the largest number of panicles per plant in studies on 9 oat varieties. The work was done at Iowa Agricultural Experiment Station, in cooperation with USDA.

The tests were conducted at various seeding and fertilizing rates over a 3-year period. The response to nitrogen was favored by thin seeding (1 bushel per acre) since thick seeding does not encourage tillering.

Nitrogen was applied by broadcasting ammonium nitrate. The expression of nitrogen response was permitted by making a uniform application of 0–20–20 at 300 pounds per acre prior to seeding to provide ample phosphorus and potassium.

Potential cordage crop

A fast-growing, high-yielding hybrid of the familiar pot-grown "snake plant" looks promising as a cordage-fiber crop for the United States.

This semiwild perennial plant, sansevieria, may become commercially practicable on southern muck soils, in view of research findings by USDA and the Florida Agricultural Experiment Station. Although frost kept parent species from reaching commercial maturity, it didn't winterkill the new, more vigorous hybrid.

At present, almost all our cordage fiber is imported. Sansevieria fiber has never been produced commercially here because of the difficulties in growing, harvesting, and processing it. Research within the past 14 years, however, has improved propagation, growth, and harvest.

Six-inch leaf cuttings planted 8 inches apart in rows 16 inches apart gave satisfactory plants for fiber production. A practical planting rate of 2½ to 5 acres daily was achieved with a 5-row, tube-type planter.

Further tests are needed to determine the proper height at which leaves should be cut to withstand unusually cold winters, such as that of 1957–58. Further research is also needed on machinery that will cut the long, slippery leaves and remove nonfibrous waste material.

Utah certified

Utah has become the first Intermountain State and second Western State to be declared modified-certified brucellosis free. This means that not more than 1 percent of Utah's cattle and not more than 5 percent of its herds have brucellosis. That's one of the Nation's costliest and most contagious cattle diseases.

Other certified States include Pennsylvania, Rhode Island, Connecticut, Delaware, Maine, Minnesota, New Hampshire, New Jersey, North Carolina, Vermont, Washington, and Wisconsin. Thirty-six percent of U. S. counties have this certification.

Grass vs. grasshoppers

Grasshopper populations are often barometers of range conditions says USDA entomologist N. J. Nerney.

Observations of range grasshoppers on the San Carlos Apache Indian Reservation in Arizona were made in cooperation with the Bureau of Indian Affairs from 1953 to 1956. The studies showed that differences in population levels are related to differences in the amount of perennial-grass cover. Good range management does not destroy grasshoppers, but it increases the perennial grass cover, which in turn reduces the amount of succulent annuals. Succulents are the preferred food plants

of many grasshopper species and essential to maximum egg production.

Also, good management reduces the competition between insects and livestock for available forage.

In a heavily grazed area with sparse grass, about 70 percent of the herbage was eaten by an average of about 15 grasshoppers per square yard. In contrast, about 20 percent was eaten by equal numbers in moderately grazed, fairly good grass.

Freezer temperatures

It's widely known that low temperatures (0° F. or lower) protect frozen-food quality, and high temperatures adversely affect it. But *unsteadiness* of temperature in freezer storage doesn't affect the quality of the food, USDA research shows.

Up to now, it hasn't been known whether temperature fluctuations—caused by cycling of equipment or by differences in day and night operations—accelerate quality loss.

Studies at the ARS Western utilization division, Albany, Calif., showed that chemical reactions causing *color, flavor,* or *vitamin losses* move at certain speeds at each temperature level. These changes take place faster or slower, depending upon the temperature level; and the effects of the changes accumulate. But the actual up-and-down movement of temperature has no effect on the speed of the reactions.

Other research in the same time-

UNITED STATES GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS, WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID PAYMENT OF POSTAGE, $300 (GPO)

temperature-tolerance work at Albany showed, however, that *moisture loss* from frozen turkeys is increased by temperature fluctuations. More frost accumulated in polyethylene packages of turkeys where temperature varied from −10° F. to 10° F., than in similar packages held steadily at 10° F. (highest level of fluctuation).

Eating quality of both turkeys was the same, because not enough moisture was removed to make a detecta-

ble difference. Moisture movement in frozen foods isn't a chemical change. Moreover, it's well controlled in commercial practice by modern packaging and improved storage conditions.

Obsolete farm buildings

Rapid changes in our agriculture are reflected in the increasing number of farm buildings either obsolete or not adaptable to labor-saving equipment, a USDA survey shows.

The survey was directed to hundreds of farmers and people having a direct interest in agriculture, including equipment dealers, agricultural instructors in high schools and colleges, bankers, county farm agents, and home demonstration agents.

The consensus of ARS agricultural engineers, reported at a meeting of the American Society of Agricultural Engineers, is that farm buildings for tomorrow must be efficient and easily adaptable to changing agriculture. Increasing mechanization of building operations will require efficient but not excessively costly ways of handling materials.

Feedstuffs from tung

Scientists at USDA's Southern utilization division at New Orleans have succeeded in isolating two toxins from tung meal. This is the first step toward finding a commercially practical method to detoxify the meal, a potentially valuable feedstuff.

The meal contains 22 to 25 percent protein but is highly toxic to animals and poultry. The meal has found little use except as a fertilizer.

One of the toxins is insoluble in organic solvents and is easily detoxified by heat. The other toxic material is extractable by many organic solvents and is comparatively stable.

Seed laboratory opens

USDA's National Seed Storage Laboratory at Colorado State University, Fort Collins, will soon house all introduced seed species remaining from 60 years of plant exploration.

The laboratory will be a repository for valuable breeding stocks, including many of the wild relatives and primitive varieties of our important farm crops. Many of these have useful characteristics, such as disease or insect resistance, cold hardiness, or superior growth qualities. They may prove of great value to breeders trying to improve commercial varieties of crop plants.

Seeds accepted for storage under ideal temperature and humidity conditions in the new laboratory will become Federal property. However, all of the seeds will be available to qualified researchers without cost.

Fertilize Meyer zoysia

Fertilizer is as necessary for the development and maintenance of Meyer-zoysia lawns as it is for lawns composed of other turf grasses.

Field observations by USDA scientists indicate that Meyer zoysia will grow and persist over a wide range of soil types and at very low fertility levels. However, these field trials show that the grass can be expected to perform much more satisfactorily and develop a much better turf in less time when the soil is about neutral and when adequate amounts of plant nutrients are made available.

Greenhouse and field tests prove that nitrogen is the most important element contributing to rapid top and runner growth and root development of this grass, although phosphorus and potassium are also important.

In addition to an initial spring application of 30 pounds of a complete fertilizer (10–10–10) per 1,000 square feet, Meyer-zoysia lawns should be fertilized monthly. Ammonium nitrate applied at the rate of 3 to 5 pounds per 1,000 square feet will supply the additional nitrogen.

U. S. GOVERNMENT PRINTING OFFICE: 1958